

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Larry C. Olsen et al.

Application No. 10/726,744

Filed: December 2, 2003

Confirmation No. 6833

For: THERMOELECTRIC DEVICES AND
APPLICATIONS FOR THE SAME

Examiner: Jeffrey Thomas Barton

Art Unit: 1795

Attorney Reference No. 23-65037-01

CERTIFICATE OF MAILING

I hereby certify that this paper and the documents referred to as being attached or enclosed herewith are being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: MAIL STOP RCE, COMMISSIONER FOR PATENTS, P.O. BOX 1450, ALEXANDRIA, VA 22313-1450 on the date shown below.

Attorney or Agent
for Applicant(s)

A handwritten signature in black ink, appearing to be "C. Olsen", written over a horizontal line.

Date Mailed

5/20/08

MAIL STOP RCE
COMMISSIONER FOR PATENTS
P.O. BOX 1450
ALEXANDRIA, VA 22313-1450

DECLARATION UNDER 37 C.F.R. § 1.131

We, Larry C. Olsen, Peter M. Martin, John W. Johnston and John G. DeSteeze, declare as follows:

1. We are joint inventors of the above-identified application.
2. We have reviewed the Office action dated February 29, 2008. It is our understanding that certain claims are rejected in the Office action dated February 29, 2008, as allegedly being anticipated under 35 U.S.C. § 102(e) and unpatentable under 35 U.S.C. § 103(a) by U.S. Pat. Pub. No. 2004/0231714 A1 ("Stark"), which has an alleged priority date of May 19, 2003.
3. Exhibit A hereto is a true copy of an Invention Report document signed prior to May 19, 2003, disclosing and illustrating reduction to practice inventions recited in certain of the pending claims. Exhibits B-1 and B-2 are computer screen shots showing photographs taken by Tim Peters (and photographs alone) of equipment we had built and used to test and evaluate, prior to May 19, 2003, the embodiment of the power source of the invention that is shown in the photographs and as recited in certain of the pending claims. Exhibit C is a computer screen shot

showing a photograph taken prior to May 19, 2003 of an embodiment of the power source of the invention and as recited in certain of the pending claims, the power source embodiment being a flexible substrate with bismuth-telluride thermocouples and metal bridges between thermoelements, the substrate formed in a coil configuration, which embodiment we had built and tested prior to May 19, 2003. The redacted portions of the Exhibits do not qualify or dispute any of the unredacted portions.

4. We conceived of and reduced to practice in the United States thermoelements comprising Bi_xTe_y , Sb_xTe_y , Bi_xSe_y , and/or some combination thereof where x is about 2 and y is about 3 as recited in certain of the claims prior to May 19, 2003. See Exhibits A-C.

5. We conceived of and reduced to practice in the United States co-sputter depositing n-type and p-type thermoelements comprising Bi_xTe_y , Sb_xTe_y , Bi_xSe_y , and/or some combination thereof where x is about 2 and y is about 3 as recited in certain of the claims prior to May 19, 2003. See Exhibits A-C.

6. We conceived of and reduced to practice in the United States the use of a flexible substrate with the semi-conductor thin-film thermoelements as recited in certain of the claims prior to May 19, 2003. See Exhibits A-C.

7. We conceived of and reduced to practice in the United States the use of a flexible substrate with the semi-conductor thin-film thermoelements wherein the flexible substrate is formed in a coil configuration as recited in certain of the claims prior to May 19, 2003. See Exhibits A-C.

8. We conceived of and reduced to practice in the United States a power source comprising a flexible substrate with a co-sputter deposited thin film p-type and n-type thermoelements with electrically conductive members electrically connecting the thermoelements, wherein the thermoelements comprise Bi_xTe_y , Sb_xTe_y , or Bi_xSe_y wherein x is about 2 and y is about 3, as recited in certain claims, prior to May 19, 2003. Exhibits B, B-1 and

B-2 illustrate the reduction to practice of this power source. Exhibits A-C illustrate conception and reduction to practice of the flexible substrate with the thermoelements as set forth above and as recited in certain claims.

9. We conceived of, in the United States, a power source formed using the thin films described above, wherein the power source had a volume of less than about 10 cm^3 and an output of from $1 \text{ } \mu\text{W}$ to 1 W as recited in certain of the claims prior to May 19, 2003. E.g., see Exhibits B, B-1, B-2 and C. We worked diligently toward reducing to practice (by building and testing an embodiment of the invention) the inventions as recited in certain of the pending claims, including the power source formed using the thin films described above, wherein the power source had a volume of less than about 10 cm^3 and would be capable of having an output of from about $1 \text{ } \mu\text{W}$ to about 1 W if further thermocouples of the same type were included in the device, from a date prior to May 19, 2003 up through our reduction to practice.

10. We conceived of and reduced to practice in the United States a power source having the thin films (as described above) formed on a flexible substrate formed into a coil configuration as recited in certain of the claims prior to May 19, 2003. See Exhibits A-C.

11. All statements made herein and of our own knowledge are true and all statements made on information are believed to be true; and further, these statements were made with the knowledge that willful false statements and like are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that any such willful false statements made may jeopardize the validity of the application or any patent issuing thereon.

Date May 19, 2008

Larry C Olsen
Larry C. Olsen

Date May 19, 2008

Pt M Mat
Peter M. Martin

Date _____

John W. Johnston

Date May 19, 2008

John G. DeStee
John G. DeStee

INVENTION REPORT

IR No. 13664-B
Date Received _____
Source Lab
☐ PNNL
☐ BCO

B&R CODE: _____

General Procedure

- (1) Each page of the description, including any drawing(s) or photograph(s), must be signed and dated by each inventor and two witnesses who have read and understand the invention and the entries on this Invention Report.
- (2) Send the original and two copies to the Intellectual Property Services (IPS) (PNNL) or the Intellectual Property Law Department (IPLD) (BCO).
- (3) If you have questions, please call the appropriate IP office.

TITLE

Sputter Deposition of Bi₂Te₃ and Related Alloys for Thermoelectric Applications

Inventor Name(s)	Home Address	Payroll No	Citizenship	Org Code	Line Manager
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
4					
5					

Witness 1 Name: [REDACTED] Witness 2 Name: [REDACTED]

PNNL FUNDING SOURCE FOR CONCEPTION OR DEMONSTRATION

- 1830

☐ DOE

☐ Other Govt. Agency Related Services

☐ LDRD

☐ Work for Others

☐ CRADA # _____

1831 OR BATTELLE PRIVATE

☐ 1831 Contract # _____

☐ Industrial

☐ Federal Govt.

☐ State & Local Govt.

Battelle Funds:

X ☒ PNNL IR&D

☐ BMI Core Tech or Tech Platform

☐ BMI Commercial Mkt Sector

☐ BMI IR&D

☐ BCO-Gov't Mkt Sector

No funds:

☐ Personal Time

1831 or Battelle Private Cont.

Was 1830 data necessary for conception or test?

☐ Yes ☐ No

If yes, was the 1830 data available to the public?

☐ YES ☐ NO

If yes, reference/publication # _____

Provide Work Package No.(s) used for conception: [REDACTED]
Provide Work Package No.(s) used for reduction to practice: [REDACTED]
Funding Market Sector: _____ Funding Tech Platform: _____

BCO FUNDING SOURCE FOR CONCEPTION OR DEMONSTRATION

- ☐ Industrial

Client Name: _____

Contract No.: _____

☐ Govt.

Agency: _____

If DOE, 1830 related? ☐ Yes ☐ No

Contract No.: _____

☐ IR&D

☐ Battelle

☐ Private (on own time)

Provide Work Package No.(s) used for conception: _____
Provide Work Package No.(s) used for reduction to practice: _____

Page 1

INVENTOR SIGNATURES			
1 Signature <i>Larry C. Olsen</i>	Date [REDACTED]	2 Signature <i>P. M. Miao</i>	Date [REDACTED]
Signature <i>John W. G. Hunter</i>	Date [REDACTED]	4 Signature	Date
WITNESS SIGNATURES			
Witness 1 Signature <i>W. L. Bennett</i>	Date [REDACTED]	Witness 2 Signature <i>Donald J. Fickert</i>	Date [REDACTED]

EXHIBIT A

ORIGIN

Date of Conception

Date of 1st Record

First disclosed to:

John DeSteele

Identify 1st Record

☐ This form

☐ Lab Record Book # _____

☒ Other (identify the document, page Nos. and location) Lab Data Book, Rm 120,

Test/Proof-of-Principle/Reduction to Practice

☒ Yes ☐ No

Date of Test

disclosed outside of Battelle

☐ Yes ☒ No

If yes, to whom?

If yes, describe in attached test record

☐ Drawings ☐ Report

☐ Other attachments

Disclosure was

☐ Oral ☐ Written ☐ Proprietary

PUBLISH/USE

Has the invention been published?

Do you plan to publish/present the invention?

If Yes, please include a copy of the publication when you send this completed form in.

Do you plan to disclose/demonstrate the invention or have you disclosed/demonstrated the invention to non-Battelle, non-government personnel?

If yes, is there now, or do you plan to have a Non-Disclosure Agreement in place covering the disclosure to such personnel?

Has the invention been used or planned to be put into use?

Enter text or graphics in the shaded areas below and double click Help for assistance.

ABSTRACT

Help This invention describes a process for sputter deposition of thin films of alloys of Bi₂Te₃, Sb₂Te₃, and Bi₂Se₃ for thermoelectric energy conversion. The approach allows deposition of these films on glass and flexible substrates such as Kapton. The process was used to deposit n-type and p-type films that exhibit properties nearly as good as measured for bulk materials.

RELEVANT KEYWORDS (Optional)

Help Thermoelectric films, thin films, power sources

Page 2

INVENTOR SIGNATURES

1 Signature <i>Harry C. Olsen</i>	Date [Redacted]	2 Signature <i>Pat M. Mart</i>	Date [Redacted]
3 Signature <i>John W. Johnson</i>	Date [Redacted]	4 Signature	Date

WITNESS SIGNATURES

Witness 1 Signature <i>W. J. Johnson</i>	Date [Redacted]	Witness 2 Signature <i>Donald J. Davis</i>	Date [Redacted]
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EXHIBIT A

DETAILED DESCRIPTION OF THE INVENTION

[REDACTED]

The best thermoelectric materials for power generation in the 0°C to 100°C temperature range are semiconductors and related alloys based on the bismuth-antimony-telluride-selenium (Bi-Sb-Te-Se) materials system. This disclosure concerns procedures that have been developed which allow the sputter deposition of thin films of these materials that can be utilized to fabricate high voltage, low power thermoelectric (TE) power sources. Films were deposited by RF magnetron sputtering simultaneously from two of three possible sources, namely, targets made of Bi₂Te₃, Sb₂Te₃, and Bi₂Se₃. RF power supplied to each of the targets, substrate temperature and sputtering gas pressure were varied to determine deposition conditions that resulted in films with appropriate properties. Figure 3 describes the variation of material parameters with sputtering conditions. N-type TE material is obtained by supplying RF power of 30 watts to a Sb₂Te₃ target and 20 watts to the Bi₂Te₃ target, and with the substrate at the ambient temperature, whereas p-type material was achieved with power levels of 30 watts and 10 watts to the Sb₂Te₃ and Bi₂Te₃ targets, respectively. A sputtering gas pressure of 3 millitorr was utilized in both cases. A picture of a miniature thin film TE couple fabricated with the disclosed process is shown in Figure 4.

The disclosed process will allow the deposition of hundreds of TE couples on flexible material such as Kapton.

[REDACTED]

[REDACTED]

Help

Page 3

INVENTOR SIGNATURES			
1 Signature	<i>Larry C. Olson</i>	Date	[REDACTED]
2 Signature	<i>Pat M. Maas</i>	Date	[REDACTED]
3 Signature	<i>John W. Hunter</i>	Date	[REDACTED]
4 Signature		Date	[REDACTED]
WITNESS SIGNATURES			
Witness 1 Signature	<i>Wendy D. Smith</i>	Date	[REDACTED]
Witness 2 Signature	<i>Donald C. Jones</i>	Date	[REDACTED]

EXHIBIT A

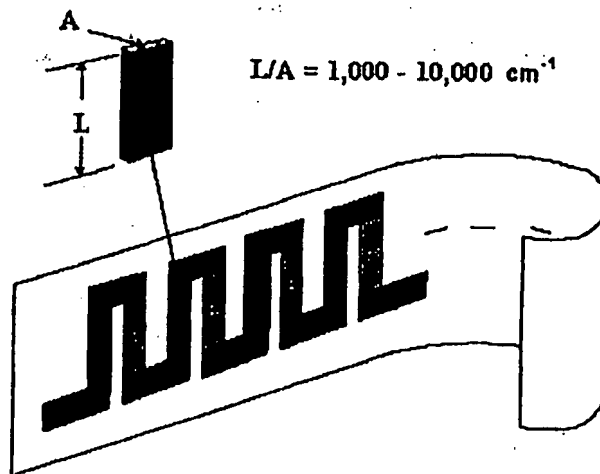


Figure 2. Concept of a TE Module Based on Thin Films on a Flexible Substrate.

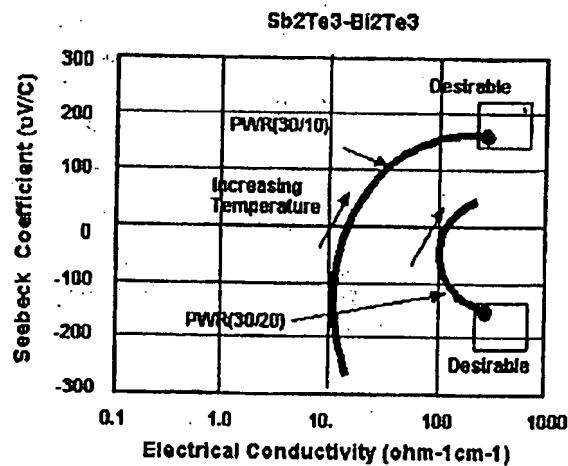


Figure 3. Variation of Seebeck coefficient with electrical conductivity for a range of sputtering parameters.

Page 4

INVENTOR SIGNATURES			
1 Signature <i>Larry Ellison</i>	Date [Redacted]	2 Signature <i>Pete M. Mat</i>	Date [Redacted]
3 Signature <i>John W. Johnson</i>	Date [Redacted]	4 Signature [Redacted]	Date [Redacted]
WITNESS SIGNATURES			
Witness 1 Signature <i>Wendy A. Seibert</i>	Date [Redacted]	Witness 2 Signature <i>Donald L. DeWitt</i>	Date [Redacted]

EXHIBIT A

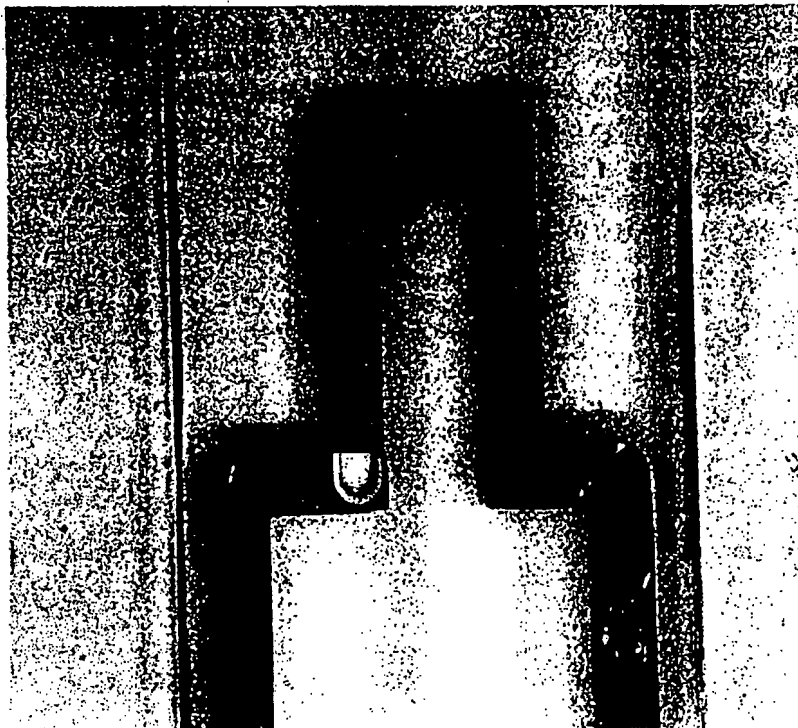


Figure 4. Picture of thin TE couple deposited with the disclosed process.

Page 5

INVENTOR SIGNATURES			
1 Signature	<i>Harry C. Chen</i>	Date	<i>[Redacted]</i>
2 Signature	<i>Pat M. Mait</i>	Date	<i>[Redacted]</i>
3 Signature	<i>John W. Johnson</i>	Date	<i>[Redacted]</i>
4 Signature		Date	
WITNESS SIGNATURES			
Witness 1 Signature	<i>Wendy [Redacted]</i>	Date	<i>[Redacted]</i>
Witness 2 Signature	<i>Donald H. Jones</i>	Date	<i>[Redacted]</i>

EXHIBIT A

POSSIBLE APPLICATIONS (Optional)

Help

PRIOR ART (Optional)

Help

PRODUCT DIFFERENTIATION (Optional)

Help

STATUS OF THE INVENTION (Optional)

Help

ADDITIONAL CONSIDERATIONS (Optional)

Help

(PNNL Only) LINE MANAGER OR AUTHORIZED DERIVATIVE CLASSIFIER (ADC) SIGNATURE

1. To the best of my knowledge and belief, the attached description ☐ DOES ☒ DOES NOT contain information classified as RESTRICTED DATA, related to national security or to uranium enrichment, or related to storage and disposal of high level nuclear waste or spent fuel, or other sensitive or restricted data (e.g., UCN, export control).
2. If the technology described in the attached description was generated in a classified or potentially classified subject area, an Authorized Derivative Classifier should review it.

☒ Line Manager
☐ ADC

Signature

Pete M. Mat

Date

[Redacted]

Page 6

INVENTOR SIGNATURES			
1 Signature <i>Larry O. Hiron</i>	Date <i>[Redacted]</i>	2 Signature <i>Pete M. Mat</i>	Date <i>[Redacted]</i>
3 Signature <i>John M. Johnston</i>	Date <i>[Redacted]</i>	4 Signature	Date
WITNESS SIGNATURES			
Witness 1 Signature <i>William D. Stewart</i>	Date <i>[Redacted]</i>	Witness 2 Signature <i>Donald B. Stewart</i>	Date <i>[Redacted]</i>

EXHIBIT A

From: DeSteeze, John G [mailto:john.desteese@pnl.gov]
Sent: Monday, April 14, 2008 3:17 PM
To: [REDACTED]
Cc: Matheson, James D; Olsen, Larry C; Silva, Robert R
Subject: FW: Pictures of Test Set-Up

[REDACTED]
I am forwarding Tim Peter's e-mail showing reduction to practice to show the date stamp on the original.
John D.

From: [REDACTED]
Sent: [REDACTED]
To: DeSteeze, John G
Subject: Pictures of Test Set-Up

Attached



teflmst1.jpg (252
KB)



teflmst2.jpg (227
KB)

<<teflmst1.jpg>> <<teflmst2.jpg>>

EXHIBIT B

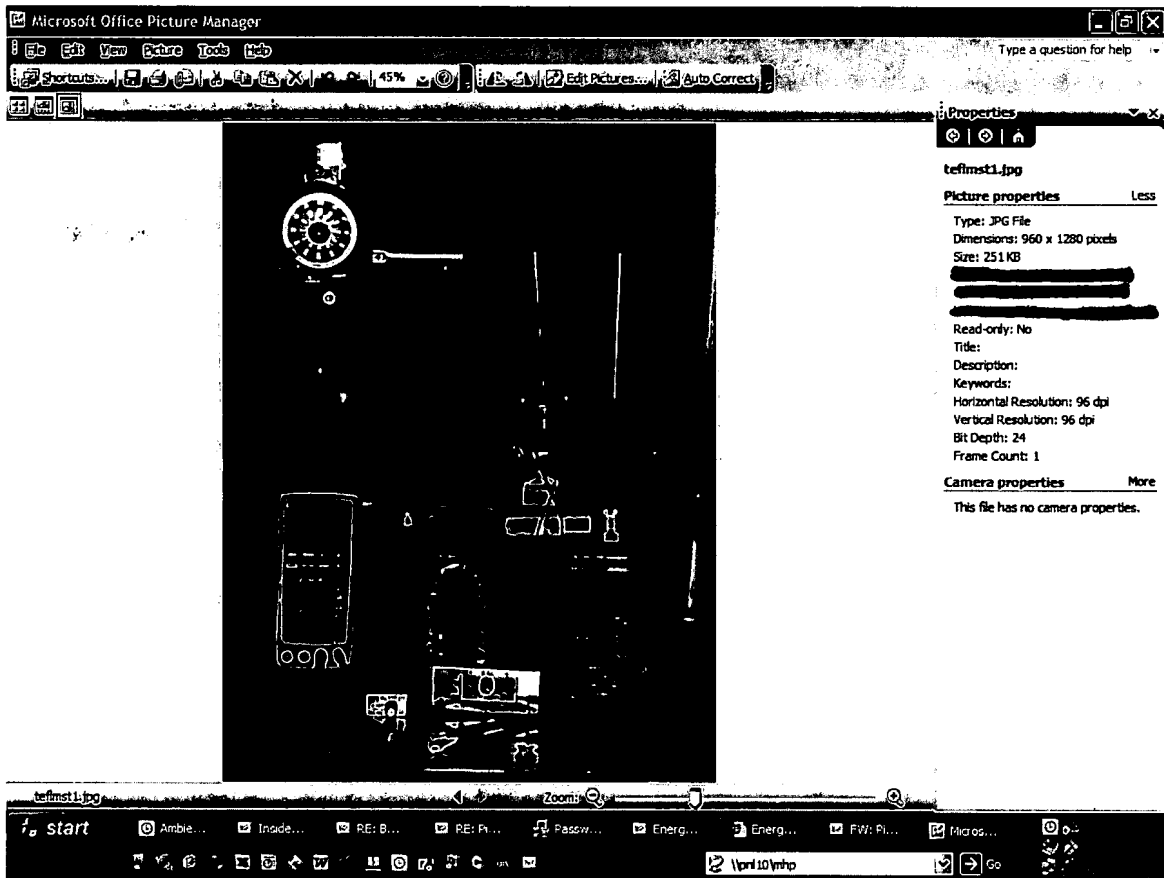




EXHIBIT B-1

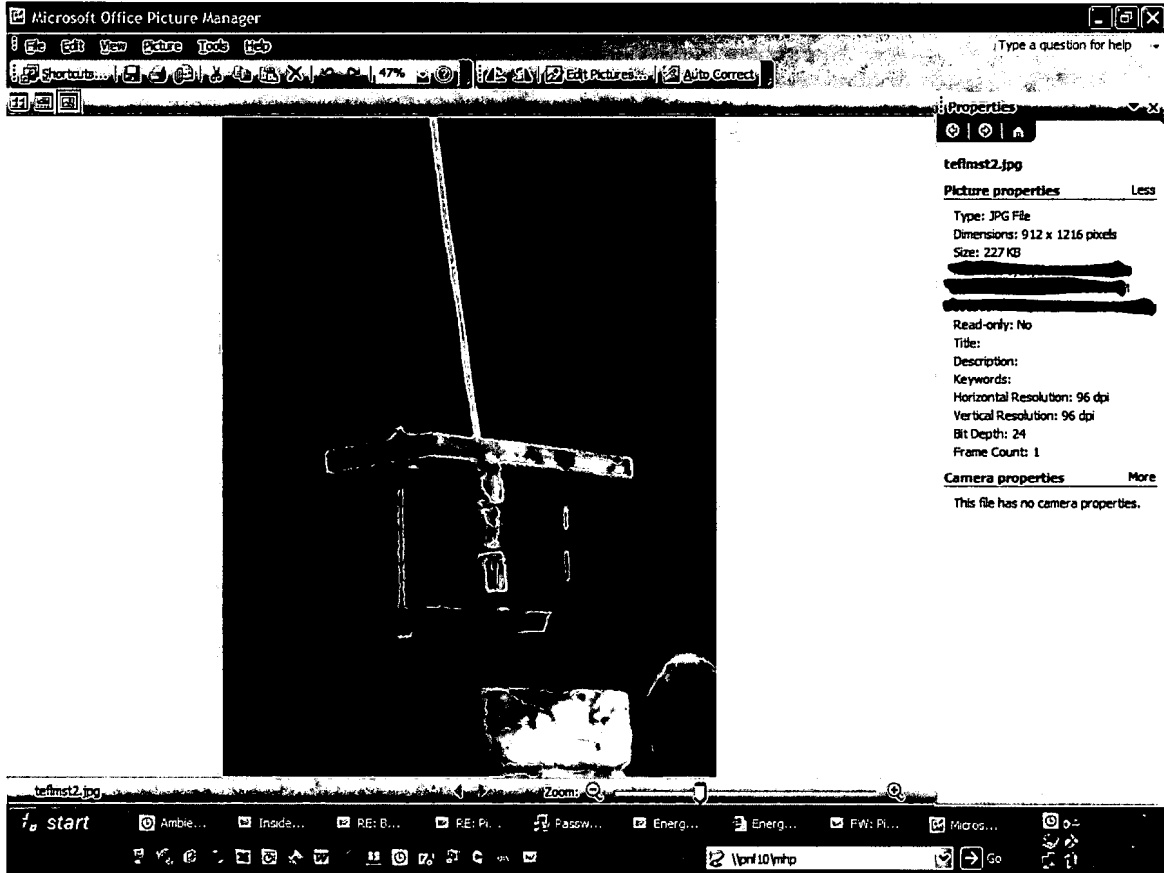


EXHIBIT B-2

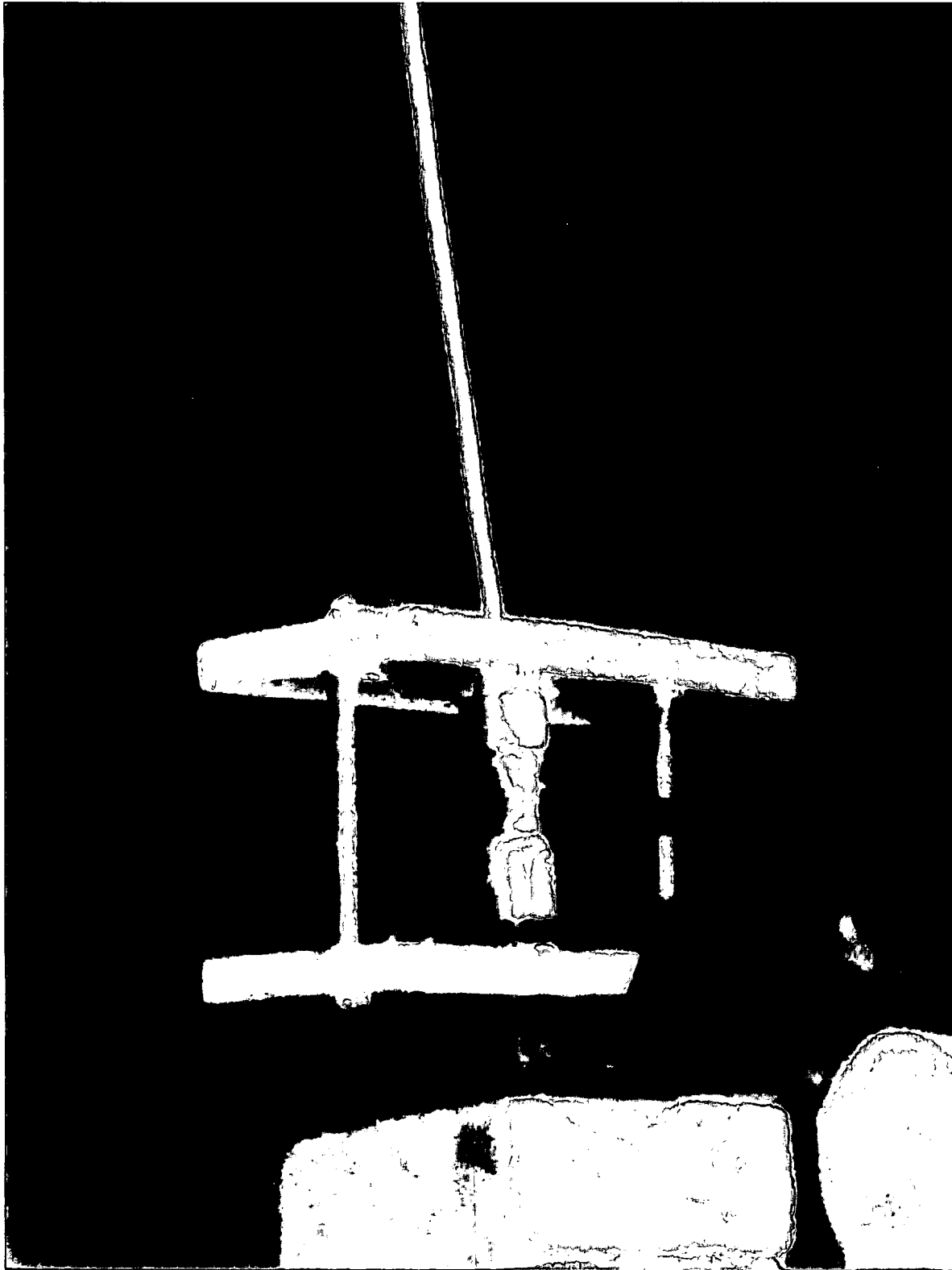


EXHIBIT B-2

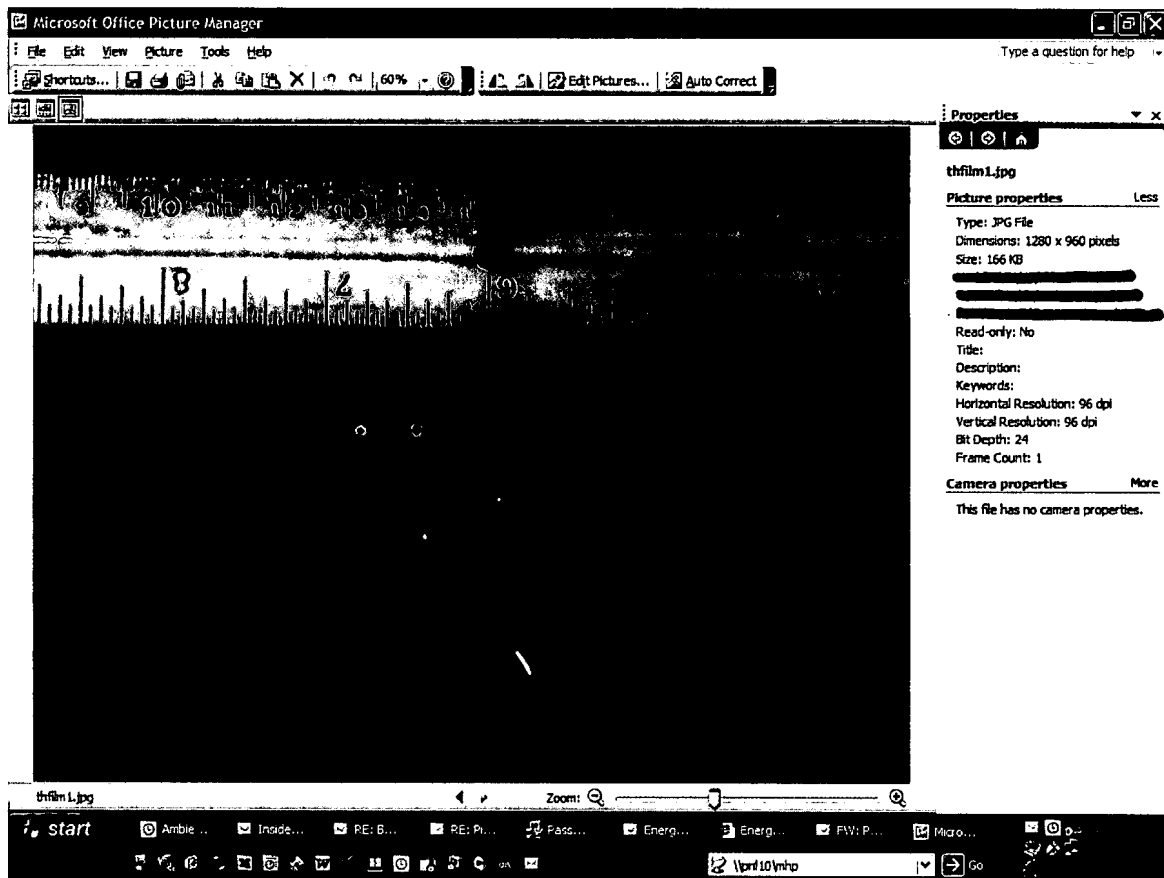


EXHIBIT C

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Larry C. Olsen et al.

Application No. 10/726,744

Filed: December 2, 2003

Confirmation No. 6833

For: THERMOELECTRIC DEVICES AND
APPLICATIONS FOR THE SAME

Examiner: Jeffrey Thomas Barton

Art Unit: 1795

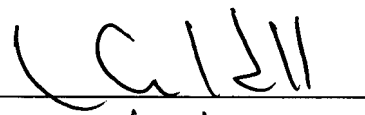
Attorney Reference No. 23-65037-01

CERTIFICATE OF MAILING

I hereby certify that this paper and the documents referred to as being attached or enclosed herewith are being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: MAIL STOP RCE, COMMISSIONER FOR PATENTS, P.O. BOX 1450, ALEXANDRIA, VA 22313-1450 on the date shown below.

Attorney or Agent
for Applicant(s)

Date Mailed


5/20/08

MAIL STOP RCE
COMMISSIONER FOR PATENTS
P.O. BOX 1450
ALEXANDRIA, VA 22313-1450

**STATEMENT OF FACTS IN SUPPORT OF FILING ON BEHALF OF
NON-SIGNING INVENTOR JOHN W. JOHNSTON**

This Statement is filed by Derek H. Maughan, is made as to the exact facts that are relied upon to establish that diligent effort has been made to reach inventor John W. Johnston to obtain execution of the presently filed §1.131 Declaration for the above identified patent application before deposit of the Declaration in the Patent and Trademark Office.

I, Derek H. Maughan, an adult of competent age and capacity do hereby declare from personal knowledge that:

1. I am a patent attorney for Battelle Memorial Institute.
2. Inventor John W. Johnson, of the aforementioned patent was an employee of Battelle Memorial Institute and as such by virtue of his employment contract was under obligation to assign all of right, title, and interest in the aforementioned patent to Battelle Memorial Institute. A true and correct copy of an Inventions and Proprietary Information Acknowledgment Agreement reflecting this obligation is attached as Exhibit A to this Declaration and incorporated by reference.

3. Inventor Johnson has since retired from Battelle Memorial Institute.

4. In response to the Examiner's Office Action listed above, we attempted to obtain the signature of Inventor John W. Johnson on the attached 1.131 declaration. Our phone calls, Federal Express delivery attempts and Certified Mail were unsuccessful. We have not been able to contact Inventor John W. Johnson.

5. We have been notified by his daughter that Inventor John W. Johnson is out of the country and out of contact for an extended period of time and will not return until after the statutory period for response to the outstanding Office Action has expired. Therefore we are unable to obtain a Inventor's signature on the attached Declaration because of the Inventor's unavailability.

6. Therefore we respectfully request that in light of these circumstances that the accompanying Declaration be accepted without Inventor John W. Johnsons' signature.

7. All statements made herein and of my own knowledge are true and all statements made on information are believed to be true; and further, these statements were made with the knowledge that willful false statements and like are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that any such willful false statements made may jeopardize the validity of the application or any patent issuing thereon.

I am signing on behalf of Assignee, Battelle Memorial Institute, who has sufficient proprietary interest in this application as evidenced by the recorded assignment for this application. This Statement is being made by the available person having first-hand knowledge of the facts recited herein.

Date

5/19/2008

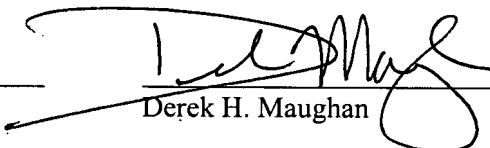

Derek H. Maughan

EXHIBIT A

**Battelle Memorial Institute
Pacific Northwest Division****INVENTIONS AND PROPRIETARY INFORMATION ACKNOWLEDGMENT**

I, John W. Johnston, in exiting/transferring/beginning a leave of absence from my employment with Battelle Memorial Institute effective November 30, 2004, have been reminded that inventions conceived or made during the course of my employment at Battelle belong to Battelle or the sponsor organizations who employ Battelle to conduct research. I have also been reminded that information, which I received during my employment at Battelle, is sensitive information belonging to Battelle or the sponsor organizations. Battelle is bound by contract to disclose inventions made by Battelle Staff Members to the sponsor organizations, and not to reveal research objectives or research results without permission of the sponsor organization.

Specifically, I have been reminded of five clauses in the employment agreement, which obligate me as follows:

"(2) **CONFIDENTIALITY** - Proprietary or business sensitive information is information not generally known to the public, and which, if released to unauthorized persons, would be detrimental to the reputation or business interests of Battelle or parties with which it contracts, or would permit such unauthorized persons to benefit improperly. I recognize that such proprietary or business sensitive information is the property of Battelle, and I will not disclose to others (except as required in my duties to Battelle), nor will I use for my own or another's benefit any such proprietary or business sensitive information, either during my employment or thereafter."

"(3) **RETURN OF RECORDS** - In changing status of employment by exiting/transferring/beginning a leave of absence, I will deliver to Battelle all records, reports, data, memoranda, notes, models, and equipment of any nature that are in my possession or under my control, prepared or acquired in the course of my employment relationship with Battelle. Further, I agree not to take with me any such information or data, or reproductions of any such information, that relate to the business activities of Battelle or to parties in a contract relationship with Battelle."

"(4) **INVENTIONS, IDEAS, AND OTHER INTELLECTUAL DEVELOPMENTS** - In view of the purposes of Battelle, and the need to secure for parties contracting with Battelle their right to resulting intellectual developments, I understand that Battelle must be in a position to use, assign, and otherwise dispose of intellectual developments made by its staff members. Accordingly, except for those items excluded by paragraph entitled "INVENTIONS, IDEAS, AND OTHER INTELLECTUAL DEVELOPMENTS", I will promptly disclose to Battelle, and, when requested, furnish to Battelle a complete record of every such intellectual development, including any discovery, invention, improvement, innovation, design, copyright, and other definite and useful idea or compilation of information of value (intellectual development), which I may make or originate, individually or with others, at any time during the term of my employment by Battelle, I hereby assign to Battelle or its nominee the entire rights throughout the world to such intellectual developments which relate to the current or potential business or activities of Battelle, its subsidiaries or affiliates, or which result from my work for Battelle."

The business of Battelle means those activities of Battelle, its subsidiaries and affiliates which are carried on in pursuit of the purposes of Battelle, including: scientific research and scientific development; creative activities of a scientific nature; activities which directly encourage or assist scientific research, scientific development; education for and in connection with the above activities; in furtherance of the above, the reduction to practice, licensing, and other disposal of inventions, discoveries and developments; and the advancement of learning and better education of men and women for employment.

"(5) **COOPERATION** - I will fully cooperate with Battelle or its designees in securing, in the name of Battelle or its designees, rights with respect to the intellectual developments described in Paragraph 4 above, in all countries. I will promptly execute all proper documents presented for signature and do all things reasonably required to enable Battelle or its designees to accomplish the above, at any time during or after my employment."

"(6) **INFORMATION AND TESTIMONY** - I will, without expense to me, give such true information and testimony, under oath if requested, as may be requested by Battelle or its designees relative to any discoveries or other intellectual developments described in Paragraph 4 above."

In summary, I consider all information which is related to the business of Battelle-Northwest or its sponsors or affiliates and which was developed by me or disclosed to me while employed at Battelle to be proprietary or "business sensitive" unless specifically identified to the contrary.

Alice Gutierrez 11/12/04

Witness

John W. Johnston

Staff Member
11-18-04

Date

EXHIBIT

A